# Section 7
# Alternatives Considered

## 7.1 Introduction

Riverside Public Utilities (RPU) proposes to build and operate a nominal 96-megawatt (MW) simple-cycle power plant on a 12-acre fenced site within the City of Riverside, California. The proposed facility is referred to as the Riverside Energy Resource Center (RERC) Project (Project). RPU will develop, build, own and operate the facility. RERC will supply the internal needs of the City of Riverside during summer peak electrical demands and will serve the City's minimum emergency loads in the event RPU is islanded form the external transmission system. No power from RERC will be exported outside of the City.

As part of the Project development process, the City assessed a number of alternatives. An alternative size/facility configuration was evaluated in the context of the City's power requirements and the availability of power in the market. The plant size of 96 MW (net output) was selected. Other alternatives evaluated by the City included:

- Alternative sites.
- Generation technology and configuration alternative.
- Alternative water supply source.
- Alternative wastewater discharge disposal methods.

## 7.2 Alternative Sites

Alternative locations for the RERC Project were considered but rejected. RPU evaluated alternative sites during the planning stage of the Project. The main criteria considered in selecting a suitable site included appropriate land area, environmental compatibility, proximity to existing utilities including transmission lines, natural gas pipelines and water supply, and compatibility with local land uses and zoning. This screening process narrowed down the number of potential sites to two, with the proposed site offering the least potential environmental impact while meeting RPU's goals and objectives.

The other potential site evaluated in detail is known as the TORO site, which is owned by the City of Riverside and leased to The TORO Company. The site is approximately 0.75 miles north and east of the proposed site and consists of approximately 20 acres. The TORO site sits on a bench above the Santa Ana River and contains both undisturbed habitat as well as large areas of lawn where TORO tests lawn mowers and other garden equipment. Portions of the site are relatively flat, however, the majority of the site consists of rolling hills that drop steeply towards the Santa Ana River. This site would require a significant amount of excavation to accommodate a generation facility. Furthermore, a minimum of 4,000 feet of pipeline would be required to connect to the WWTP for water supply. Additionally, a minimum of 1,000 feet of natural gas pipeline would be required to connect to Sempra's natural gas transmission line. Black start power from the WWTP cogeneration plant would not be available at this site. Because of the economic and environmental costs associated with developing this site, including the pipelines and potential adverse environmental impacts, this site was not considered a viable alternative, and was eliminated from further consideration.

The proposed site is located directly adjacent to the City's Wastewater Treatment Plant, which is used to treat the City wastewater and generate 3 MW of power. The site is flat and has been previously disturbed in its entirety. There are substantial environmental and economic advantages to using the existing infrastructure for electrical transmission, reclaimed water supply, and on-site natural gas interconnection and black start power. Other alternative sites would have involved lengthy gas and water supply pipelines resulting in greater potential environmental impacts as well as cost.

## 7.3 Alternative Fuels and Technologies

The alternatives included plants based on alternative fuels, such as coal, biomass, waste, and oil, but these selections would generally not meet the environmental benefits of natural gas.

Alternative technologies, such as solar, nuclear, wind-generation, fuel cells or water based electric generation were determined to be cost prohibitive and infeasible for this project. Combined cycle plants are best suited for base load operation, and would not meet RPU's need for additional peaking power at this time. Biodiesel would not meet air quality limits. Only gas fired simple-cycle operation of the CTGs was considered to meet the peaking load of the City.

## 7.4 Evaporative Cooler vs. Chiller

Gas turbines are constant volume machines. At higher ambient temperature, the density of air will be lower and for the same volume of intake air, the mass of air flowing in the turbine will reduce, hence the turbine output decreases.

The gas turbines have the option for evaporative cooling or inlet air chilling for enhancing the output of the unit at higher ambient temperatures. Evaporative coolers lower the gas turbine intake air temperature by means of water spray, the best achievable inlet air temperature will be 2 or $3^0$F higher than the prevailing wet bulb temperature. On the hottest day, at an ambient of $115^0$F (DBT) and $72^0$F (WBT), the evaporative cooler can achieve an inlet air temperature of $75^0$F (DBT). Whereas, the inlet chilling system is capable of achieving the same inlet air temperature of $42^0$ to $46^0$F at all times. Thus, inlet air chilling provides an extra power boost over evaporative coolers, which is roughly 10 MW. Further, the chiller performance is not dependent upon the ambient conditions and ensures a constant and reliable output. Chillers give higher power output than evaporative coolers, but would require a separate mechanical refrigeration system with compressors, wet cooling tower and an air heat exchanger that consume electric power thus slightly reducing overall net power output. To decide whether the evaporative coolers or chillers would be most beneficial to the RERC, the gas turbine bids were invited with both options. The cost and the performance evaluation bids received showed that it would be cost effective for chillers to be installed on the proposed RERC in lieu of evaporative coolers. Because the difference in efficiency between these options is minimal, the selected LM6000 SPRINT gas turbines would be equipped with an inlet air chiller package.

## 7.5 Alternative Water Supply and Discharge

The City's potable water was considered as a source for the process and the cooling system makeup, but in order to comply with State Water Resources Control Board Resolution 75-58, readily available reclaimed water from the adjacent wastewater treatment plant has been selected for the plant use. Potable water will be used as an emergency backup should reclaimed water not be available.

Different process wastewater discharge options were evaluated. A ZLD system has been selected which eliminates any liquid discharge into the City wastewater system.

## 7.6 "No Project" Alternative

A "No Project" alternative was considered and rejected as inconsistent with the City's objectives to provide electrical power reliably and efficiently to its electric utility customers, and provide support to the Southern California area. Furthermore, the No Project Alternative would result in greater potential environmental impacts including increased fuel consumption and air pollution because new peaking generation facilities, including RERC, would not be brought into operation to displace production from older, less efficient, higher air emissions peaking power plants.

## 7.7 Transmission Line Alternatives

One alternative transmission line route was evaluated that would exit the proposed plant site and travel north and east following the Santa Ana River corridor for approximately one mile, then turn south towards the existing Mt. View Substation. This route was rejected because it would necessitate a new right of way through a relatively undisturbed area that is managed as open space. This alternative would potentially create considerable adverse impacts from construction activities in a previously undisturbed area. Because of the economic and environmental costs, accessibility and potential adverse environmental and visual impacts this route was not considered a viable alternative, and was eliminated from further consideration.

Burying the transmission line underground was also considered as an alternative. Underground transmission systems in the United States have been built since the late 1920s. The majority of the cable would be installed in conduit using open-cut trenching techniques. The basic cost of undergrounding a transmission line would be many times more expensive than the cost of overhead construction. The relatively high cost and installation requirements prohibit the application of underground transmission systems for long distance electric transmission.

While underground transmission lines are relatively immune to weather conditions, they are vulnerable to cable/splice failure, washouts, seismic events, and incidental excavation. Outages for underground lines generally last days or weeks while the problem is located, excavated, and repaired. Typically, failures in overhead lines can be located and repaired in a matter of hours. Long-term outages would be unacceptable.

During construction, the environmental impacts of an underground transmission line would be similar to those for major pipeline construction. Greater adverse environmental impacts could be expected because the entire ROW would be disturbed, and particularly because the route would cross residential areas, potential impacts in these locations would be much more significant.

An underground transmission line would be technically feasible, have few above ground structures, and thus, weaker visual contrast than above ground transmission lines. However, this alternative would create considerable adverse impacts from the necessary trenching required during construction and the much larger area needing to be rehabilitated. Because of the technical complications, economic and environmental costs, and accessibility, an underground system was not considered a viable alternative, and was eliminated from further consideration.

## *7.8 Alternative Emission Controls*

One emissions control strategy has been repeatedly used and demonstrated to meet BACT requirements for simple-cycle gas turbines. This strategy includes the use of selective catalytic reduction to reduce $NO_X$ emissions to 2.5 ppmv, combined with an oxidization catalyst to reduce co emissions to 6.0 ppmv. The SCR system uses aqueous ammonia as a reactant, to minimize the risk of accidental release and associated impacts of anhydrous ammonia that may be used in larger projects. The SCR/CO oxidization strategy has been utilized in numerous gas turbine projects and has been demonstrated to be safe, reliable and cost-effective through significant accumulated hours of operation. SCR/CO oxidization is understandably recognized by gas turbine manufacturers and by environmental regulators as the standard for BACT determinations.

One emerging technology warrants discussion as an alternative emission control strategy, but has not been adequately shown to be consistently effective and cost feasible as the proposed SCR/CO oxidization system. The first alternative is $SCONO_X$, which oxidizes $NO_X$ to $NO_2$, and is then adsorbed. The adsorption bed is periodically regenerated with hydrogen and $CO_2$. The system also oxidizes CO and ROG emissions. $SCONO_X$ has been installed in only limited applications. It's process is much more dependent upon mechanical operations than SCR and is somewhat more susceptible to "wear and tear" effects than SCR. In a recent application of $SCONO_X$ on a 13 MW Solar Titan gas turbine, guaranteed $NO_X$ emissions were not lower than the 2.5 ppmv that the proposed turbines are guaranteed to achieve using SCR. $SCONO_X$ has not been demonstrated to operate reliably on the much larger GE LM6000 turbine model that is proposed for the

Riverside ERC project. It does not appear, therefore, that $SCONO_X$ would be more effective at reducing $NO_X$ than conventional SCR for the RERC project.

Furthermore, $SCON_X$ requires steam in the reformer section. Steam will not be available in a simple cycle plant and therefore this technology would not be feasible for the RERC.

RPU's objective in selecting equipment and vendors is to ensure continuous compliance with air quality regulations and ongoing operating efficiency through a history of demonstrated performance in similar installations. None of the bidders responding to RPU's RFP proposed to use $SCONO_X$ or suggested that it be considered as a viable alternative to SCR/CO oxidization. Had $SCONO_X$ been suggested by a vendor, adequate demonstrations of performance likely would not have been made, due to the limited use of the technology to date.